copper wire at little cost in time, trouble or money.

3. The same motor may be employed for various purposes, successively and at any time, with any forms of agricultural machinery; its small size and portability permitting its transport from one point to another with ease.

4. The facility with which the current may be divided and applied permits its use in driving a number of machines, of various forms, at the same time and in different places.

5. It allows the supply, at the same time, of power for machinery and for light and even for heat.

6. It affords safety against fire, where properly established, and heat, light and power may be thus furnished at minimum risk.

7. The manipulation of the apparatus is simple and easy.

8. This system permits the instantaneous operation of fire-pumps to confine and arrest an incipient fire; it being provided with a suitable system of distributing water mains.

9. By use in prompt suppression of epidemics, by destroying the first cases, extensive contagion and resultant dangers and sacrifices of life and property are avoided.

It is thought that the great sub-division of agricultural lands in France will prevent the introduction of such systems as rapidly as is desirable for the purpose of successfully competing with adjacent countries of Europe. But it remains for the electricians and engineers to secure capital, to distribute electrical energy at low costs, to rent out apparatus and even to see it properly manipulated by furnishing expert operatives, in order that the peasant may not be called upon to provide capital which it is almost impossible for him to find. The agriculturists must combine, form syndicates, and thus make powerful that energy which is powerless in single and separated elements. The great proprietor will find it to his advantage to lead in the introduction of the new systems; setting an example to his neighbors that may later prove fruitful of great good.

In the colonies, it is stated, a spirit of threatening democracy is likely to make them, for a long time, comparatively unproductive, and even the legislators are not always without blame. "They go to their constituents with a cry against machinery which has always been most vehemently raised among these classes, especially against the introduction of machinery for hand-work." The fact is, of course, precisely the opposite, and the introduction of machinery has always benefited the workmen more than other classes. "Augmenting the returns to the proprietor, they permit him to raise the wages of those who continue to work on the soil."

R. H. THURSTON.

SCIENTIFIC BOOKS.

Geology of the Edwards Plateau and Rio Grande Plain adjacent to Austin and San Antonio, Texas, with Reference to the Occurrence of Underground Waters. By ROBERT T. HILL and T. WAYLAND VAUGHAN. From the Eighteenth Annual Report of the United States Geological Survey, 1896–97, Part II.—Papers Chiefly of a Theoretic Nature, pp. 193–321; pl. xxi.–lxiv. Washington, Government Printing Office. 1898.

This is, without doubt, one of the most important contributions to Texas geology in recent years. While the purpose of the authors is primarily to deal with the artesian water problem, they have in reality done much more, as is at once apparent by reference to their complete and detailed descriptions of the geology of this region.

"The artesian wells of the eastern half of Texas belong to several distinct systems, the term 'system' including all wells having their source in the same set of rock sheets or strata. * * * In the Cretaceous formations

alone there are no fewer than five, and two of these—the Travis Peak, or Waco, and the Edwards—receive consideration in this paper."

To those familiar with the Texas Cretaceous a change in nomenclature is at once noticeable—the term 'Travis Peak' being employed for the formation heretofore known as 'Trinity Sands,' and 'Edwards' for the 'Caprina limestone.' These and similar changes are made, as the authors state, by refining the previous nomenclature, appropriate geographic names being substituted wherever possible for paleontologic and mineralogic terms.

An investigation of the source of the artesian water at and in the vicinity of San Antonio was productive of the following results: "That while these well waters come from the same series of beds that supply the artesian wells of the Waco, Fort Worth and Dallas region north of the Colorado, their occurrence presents some important differences of detail. Instead of having their immediate source in beds of porous sands, like the wells about Waco, they are derived largely from the Edwards limestone, hitherto supposed to be one of the most impervious formations of the whole Cretaceous section" (p. 200). "It became apparent," the report continues, "that this hitherto unappreciated water-bearing formation had great possibilities for supplying with flowing or non-flowing wells a large area of country lying between Austin and San Antonio, extending west of the San Antonia River along the northern margin of the Rio Grande Plain towards the Pecos River, and even comprising the extensive summit region of the Edwards Plateau" (p. 200).

Two classes of outflowing waters are recognized—the one following the margin of the Rio Grande Plain, the other appearing in the canyons of the Edwards Plateau.

The introduction which has here been briefly outlined gives but a faint idea of the detailed work which has been so creditably done by the authors.

The geography of the region is now taken up, the chief features of which are the Rio Grande Plain, the Edwards Plateau and its 'jagged southeastward front' called the Balcones Scarp. "Broadly considered, they are a lowland plain inclining gently southeastward to the Gulf of Mexico, an upland plain rising gradually towards the northwest, and a rugged zone of separation which includes a quick ascent from plain to plain."

The Rio Grande Plain is characterized by a low relief, yet attention is called to the fact that occasionally hills of considerable magnitude are encountered; buttes, capped with limestone, or sedimentary below and igneous above; old volcanic necks, as Pilot Knob, south of Austin; rounded masses of basalt, as Sulphur Peak, in Uvalde county. "The Anacacho Hills, extending east and west in southern Kinney county and constituting the most rugose part of the plain are of still another type, consisting of a monoclinal plateau, or cuesta, sloping southward and presenting a steep scarp to the north."

Climatically the plain may be divided into the eastern, or humid and sub-humid region and the western, or arid region. Beyond Bexar county continuous cultivation is impossible on account of aridity.

The Balcones Scarp, the position of which "is determined by a complex dislocation of the rocks, the Balcones fault," is the dissected edge of the Edwards Plateau. Numerous hills of denudation, locally known as mountains, here rise above the Rio Grande Plain—in the vicinity of Austin, 400 feet; in Uvalde county, 1000 feet.

The elevated Edwards Plateau merges into the Llano Estacado. Between them there is no definite line of separation, yet their surface characters, soil and rocks, give to each a peculiarity of its own.

The main drainage of the Edwards Plateau is to the east and southeast, and, as its watershed lies well to the westward, the erosion of the streams flowing into the Pecos is but moderate.

The observer in crossing the Balcones line "experiences a sudden and complete change of scenery, with accompanying changes in floral, geologic and cultured conditions." Three simple topographic elements are presented, viz.: "The flat-topped summits of the decaying plateau; the breaks or slopes of its crenulated borders and canyoned valleys; [and] the stream ways."

The cap-rock of the plateau is the Edwards (Caprina) limestone.

As the streams of this region have an important bearing upon the underground flow of water, the Rio Frio has been selected as a type and described in detail. "The caletas and upper canyons are usually dry and waterless arroyos, except in time of storm. The flat-bottomed canyons contain permanent pools of flowing water, fed by springs and on the lower plain the running water disappears entirely or for a considerable distance."

Brief mention is also made of the caverns of the plateau, as they likewise are concerned with the question of underground waters. Three types are recognized: "(1) small cavities within individual limestone strata, giving them what is locally termed a honeycombed structure; (2) open caverns occuring in certain bluff faces along the stream valleys; (3) underground caverns of vast extent dissolved out of many strata."

The flora is next discussed. It presents three phases: that of the stream bottoms; "that of the breaks, and that of the summit." Among the interesting facts recorded mention may be made of one: the occurrence of the cypress. "This tree, which ordinarily grows only in the swamps and bayous of the low subcoastal regions, attains an enormous size at the edge of the deeper holes near the heads of permanent water of the Pedernalis, Blanco, San Marcos, Guadalupe, Cypress, Onion Creek and other streams. These localities are at altitudes from 1,000 to 1,750 feet above the sea, and hundreds of miles west of the great cypress swamps of the eastern tier of Texan counties, with which they have no possible continuity. * * * *

"Before entering upon the geology of the region a few pages are devoted to a statement of 'the general principals of artesian waters.' Under the caption 'Capacity of Rocks for Absorbing Moisture' the following succinct statement is given concerning the water-bearing strata of Texas: "The artesian water-bearing strata of the State east of the Pecos River are composed mostly of extensive sheets of sands, clays and limestones, succeeding one another in orderly arrangement, except along the Balcones zone of faulting, and in general having a gentle inclination towards the sea, so that in travelling northwestward, although constantly ascending in altitude, one encounters the outcropping edges of rock sheets of lower and lower stratigraphic position. This produces the simple arrangement of a tilted plain built up of a series of alternately impervious and pervious layers. The rain falling upon the outcropping edges of the latter sinks into the embed and by gravity is conducted seaward down the plain of its inclination to lower levels beneath the surface. Each different stratum, including any particular water-bearing stratum, becomes embedded deeper and deeper to the southeastward of the point where it outcrops at the surface."

The rocks appearing in the region under discussion are tabulated as follows:

"RECENT.	
Wash deposits of the hillsides, stream-bed material, etc.	
PLEISTOCENE.	
Onion Creek marl; Leona formation, and other terrace deposits.	
PLIOCENE.	
Uvalde formation.	
EOCENE.	
CRETACEOUS.	
Gulf Series.	
Webberville and Eagle Pass formations	Montana division.
Taylor and Anacacho formations	Montana division.
Austin chalk	Colorado division.
Eagle Ford shales	Colorado division.
Comanche Series.	
Shoal Creek limestone	Washita division.
Del Rio clay	Washita division.
Fort Worth limestone	Washita division.
Edwards limestone	Fredericksburg division.
Comanche Peak limestone	Fredericksburg division.
Walnut formation	Fredericksburg division.
Glen Rose formation	Trinity division."
Travis Peak and allied formations	Trinity division."

Most of the above formations are minutely described, especially the Cretaceous, and many measured sections given. The carefully executed work about Austin will be extremely valuable to students, as that locality affords a most inviting field for study.

The chemical lime deposits merit a line in passing. In many parts of Texas, where the country rock is chalky, some of the calcareous matter is evidently redistributed through the

agency of rains. By the subsequent evaporation of the water a superficial cement or crust is formed which may involve pebbles distributed over the surface—this is 'tepetete.'

The igneous rocks of the Rio Grande Plain occur 'along the interior margin.' They are basic. The rock from Pilot Knob has been described as nephaline-basalt.*

The arrangement of the strata is next considered. The Cretaceous rocks are shown to have great persistency, while their dip towards the coast is but slight. The Balcones fault zone has already been mentioned as forming the 'abrupt southern termination of the Edwards Plateau.' "The strata on the seaward side of the faults have been dropped down, so that any particular stratum—the top of the Edwards limestone, for instance—lies 500 to 1,000 feet lower on the coastward or downthrow side of the fracture than on the interior or upthrow side." It should, however, be borne in mind "that the fault zone really consists of many faults, having subparallel directions all concentrated in a narrow belt of country." The displacement at Mt. Bonnell, on the Colorado above Austin, is such that the Eagle Ford shales of the Gulf series are brought in contact with the Glen Rose beds of the Comanche series.

Our authors now enter upon a discussion of the water capacity of the various rock sheets. The impervious layers are, of course, non-water-bearing, and to this class, south of the Colorado River, belong nearly all the Cretaceous rocks above the Edwards limestone. On the other hand, "rocks of open texture, such as sands, conglomerates, porous and chalky limestones, and massive rocks broken by joints, fissures, honeycombs or other openings, are usually water-bearing. These are mostly found below the Del Rio clay." The proof of the water-bearing property of the Edwards limestones is supplied by the "great springs * * * bursting out of them at the head waters of the Llano, Guadalupe, Frio and Neuces Rivers;" by the artesian well records at Manor, San Marcos and San Antonio, and by the ordinary wells of the Edwards Plateau. The distribution of water is facilitated also by the honeycomb and cavernous character of certain limestone layers. The opinion is expressed that the Travis Peak and Gillespie formations, at the very base, contain "a greater quantity of water than any other beds of the Comanche series."

The underground water of the region is next taken up: (1) The waters of the Edwards Plateau; (2) The waters of the Rio Grande Plain. In many instances non-flowing wells, springs and artesian wells receive detailed treatment; of the latter logs are frequently given, as in the case of the Austin wells, the San Marcos well, the Manor well and those of San Antonio. Under the chemical qualities of the waters mention should be made of the excellent analyses of waters from Austin and vicinity, made by Dr. Henry Winston Harper, of the University of Texas.

Of the fissure springs, those at San Marcos, San Antonio, New Braunfels, Austin, etc., are well known. On p. 311 is given a table of the discharge of the various spring rivers, the San Marcos reaching 57,522,200 gallons in twenty-four hours, and the Comal 221,981,932 gallons in the same time. From a study of the strata and their faulting the authors conclude that "these waters come from the deep-seated rocks and are forced to the surface by hydrostatic pressure. Hence they are artesian in nature and constitute natural artesian wells." Taking into consideration the color, taste, temperature, volume, freedom from sulphuretted hydrogen, the conclusion is reached that "their water is derived from either the 'sweet water' horizon of the Edwards formation or the Travis Peak sands, that is, they have the same source as the purer waters of the artesian wells."

As to the source of the underground waters, the fact that the Pecos breaks the continuity of the strata renders it impossible, as the authors point out, to consider the Rocky Mountain region in this connection. They contend, on the other hand, that the Plateau of the Plains is the real source; that "much of the rain water is caught directly upon the edges of the Glen Rose and lower beds which outcrop along the western and northern summits, breaks and margins of the Plateau * * * at an elevation higher than that of their embedded continuation along

* J. F. Kemp. See Pilot Knob: 'A Marine Cretaceous Volcano,' by Robt. J. Hill and J. F. Kemp. *Amer. Geologist*, Vol. VI., 1890, p. 292.

its eastern and southern margin." Of the rainfall on the Edwards Plateau a large part must reach the water-bearing strata by percolating downward.

By the Balcones faulting, however, the continuity of the beds is broken on the southeast and south; hence the contained water must either escape through fissures, forming fissure springs, or be forced into the porous beds underlying the Rio Grande Plain—beds which occupy a different position in the geologic column, as, for instance, the porous Edwards limestone abutting the water-bearing Glen Rose beds.

The report is enriched with many excellent plates, not to mention maps and diagrams. Of the former, fourteen illustrate the characteristic fossils of the principal formations encountered in drilling for artesian water.

FREDERIC W. SIMONDS.
UNIVERSITY OF TEXAS.

A Handbook of Medical Climatology: Embodying its Principles and Therapeutic Application, with Scientific Data of the Chief Health Resorts of the World. By S. EDWIN SOLLY, M. D., M. R. C. S., Late President of the American Climatological Association. Philadelphia and New York, Lea Bros. & Co. Illustrated. Cl. 8vo. Pp. 470. Price, $4.00.

This work is a systematic treatise on climate in its medical relations. It affords precise information with reference to health resorts, enabling physicians and their patients to obtain unprejudiced reports as to localities without reliance on the scattered and often unreliable data hitherto available.

The first two sections deal with the principles of medical climatology; the effect of cold; humidity; perspiration; barometric pressure; the effect of climate as seen in different races of men; and the geographical distribution of disease.

The application of climate to the treatment of phthisis forms an important chapter of seventy pages. It bears evidence of the author's large experience with this affection. The effect of climate on other organs besides the lungs is also included.

We believe it would have been wiser not to have attempted to cover the entire globe in the treatment of this extensive subject. The portion devoted to the United States is ample so far as it relates to the Rocky Mountain Region and the Pacific Slope. It is presented in such an attractive manner that we wish that the Eastern and Middle States had been more fully exploited. At least a paragraph on Atlantic City and Cape May might well have been added, not to mention other resorts on the New Jersey coast. Bedford Springs and Glen Summit, in Pennsylvania, seem to have escaped the author's attention. In a work of this kind sins of omission are almost inevitable, and it is difficult to make the text so even as to satisfy critics from every locality. We do not know of any one better qualified to discuss the intricacies of the American climates than Dr. Solly; certainly no one hitherto has presented the subject in so attractive and useful a volume.

G. HINSDALE.

SCIENTIFIC JOURNALS AND ARTICLES.

THE first number of the *American Anthropologist*, new series, to the plans for which we have already called attention, has been issued by Messrs. G. P. Putnam's Sons. The number, which contains 200 pages and 10 plates, is made up as follows: